We claim:

1. An optical coherence domain reflectometry (OCDR) system comprising:

a. a source arm with a light source;

b. a polarizing beam splitter (PBS) having an input port optically connected to said source and two output ports;

c. a non-polarizing beam splitter having an input port optically connected to an output port of said polarizing beam splitter, said non-polarizing beam splitter having two output ports;

d. a sample arm leading to a sample, and optically connected to a first output port of said non-polarizing beam splitter;

e. a reference arm leading to a reflector, and optically connected to a second output port of said non-polarizing beam splitter;

f. a polarization manipulator for rotating the polarization of the light wave returning from the sample and reference arm to an orthogonal direction, said polarization manipulator being defined by either a single element located in between said polarizing beam splitter and said non-polarizing beam splitter or by two elements, one each in said sample arm and reference arm respectively; and

g. a detector collecting light combined by said non-polarizing beam splitter from said sample and reference arms, returned to said polarizing beam splitter in an orthogonal polarization state, and directed through a second output port of said polarizing beam splitter to a detector arm for interference signal detection and processing.

2. The OCDR system as in claim 1, wherein said sample is biological.

3. The OCDR system as in claim 1, wherein said sample is an eye.

4. The OCDR system as in claim 1, wherein said source and detector are coupled to said polarizing beam-splitter with a single mode fiber and the rest of the optical system is composed of bulk optics.

5. The OCDR system as in claim 1, wherein said sample arm includes a probe module having a one or two dimensional transverse scanning means to create an optical coherence tomography (OCT) system

6. The OCDR system as in claim 1, wherein said detector arm includes an optical dispersive element and a detector array to create a spectral domain OCDR system

7. The OCDR system as in claim 1, wherein said light source is a swept source with the center wavelength of a broadband optical radiation tunable over a certain range to create a swept source OCDR system

8. The OCDR system as in claim 1, wherein said light source is polarized.

9. The OCDR system as in claim 1, wherein said light is unpolarized, and the light is polarized by said polarizing beam splitter.

10. The OCDR system as in claim 1, wherein said light source is optically connected to the polarizing beam splitter through a polarization controller.

11. The OCDR system as in claim 1, wherein said non-polarizing beam splitter couples more light into the sample arm than the reference arm to increase the optical efficiency of the system.

12. The OCDR system as in claim 1, wherein said sample arm includes a polarization controller for selecting a desired polarization direction of the light wave onto the sample.

13. The OCD system of claim 1, wherein at least one of the said sample arm or reference arm includes an optical fiber having an optical delay line for optical path length or optical phase modulation.

14. The OCDR system as in claim 1, wherein said polarization manipulator that rotates the returned light wave polarization to an orthogonal direction is a Faraday rotator with an optical rotation angle equal to 45° + M´90°, wherein M is an integer.

15. The OCDR system as in claim 1, wherein said polarization manipulator that rotates the returned light wave polarization to an orthogonal direction is a wave plate with an optical retardation substantially equal to $\frac{\lambda}{4} + M\frac{\lambda}{2}$, wherein M is an integer and λ is the center wavelength of the light source.

16. The OCDR system as in claim 1, wherein said polarization manipulator is a wave plate with a retardation which when combined with the retardation of the sample provides a net quarter wave plate effect and hence to rotate the overall returned light wave polarization to an orthogonal direction.

17. The OCDR system as in claim 1, wherein said polarization manipulator that rotates the returned light wave polarization to an orthogonal direction is a dynamically controllable quarter wave plate.

18. The OCDR system as in claim 1, wherein said detector is a light detection module that is polarization sensitive and hence requires a fixed or predetermined polarization state of the arriving light waves.

19. The OCDR system as in claim 1, wherein said light source is a low coherence source.

20. A method for performing optical coherence domain reflectometry comprising the steps of:

a. guiding light from a light source through a polarizing beam splitter and a non-polarizing beam splitter into a sample arm leading to a sample, and a reference arm leading to a reflector;

b. combining the light waves returned from the sample arm and reference arm and guiding said light waves back to said beam splitter;

c. rotating the polarization direction of the returned light waves to an orthogonal direction prior to reentering the polarizing beam splitter; and

d. at said polarizing beam splitter, channeling said combined and returned light waves having an orthogonal polarization direction to a detector arm for interference signal extraction and processing.

21. A method as recited in claim 20, wherein the step of rotating the polarization direction of the light waves is performed prior to the returned light being combined.

22. A method as recited in claim 20, wherein the step of rotating the polarization direction of the light waves is performed after the returned light is combined.

23. An optical coherence domain reflectometry (OCDR) system comprising:

a. a source arm with a light source;

b. a polarizing beam splitter (PBS) having an input port optically connected to said source and three output ports;

c. a sample arm leading to a sample, and optically connected to a first output port of said polarizing beam splitter;

d. a reference arm leading to a reflector, and optically connected to a second output port of said polarizing beam splitter;

e. a polarization manipulator for rotating the polarization of the light wave returning from the sample and reference arm to an orthogonal direction, said polarization manipulator being defined by two elements, one each in said sample arm and reference arm respectively; and

f. a detector collecting light combined by said polarizing beam splitter, returned from said sample and reference arms in an orthogonal polarization state, and directed through a third output port of said polarizing beam splitter to a detector arm for interference signal detection and processing.

24. The OCDR system as in claim 23, wherein said sample is biological.

25. The OCDR system as in claim 23, wherein said sample is an eye.

26. The OCDR system as in claim 23, wherein said source and detector are coupled to said polarizing beam-splitter with a single mode fiber and the rest of the optical system is composed of bulk optics.

27. The OCDR system as in claim 23, wherein said sample arm includes a probe module having a one or two dimensional transverse scanning means to create an optical coherence tomography (OCT) system

28. The OCDR system as in claim 23, wherein said detector arm includes an optical dispersive element and a detector array to create a spectral domain OCDR system

29. The OCDR system as in claim 23, wherein said light source is a swept source with the center wavelength of a broadband optical radiation tunable over a certain range to create a swept source OCDR system

30. The OCDR system as in claim 23, wherein said light source is polarized.

31. The OCDR system as in claim 23, wherein said light is unpolarized, and the light is polarized by a linear polarizer.

32. The OCDR system as in claim 23, wherein said light source is optically connected to said polarizing beam splitter through a polarization controller.

33. The OCDR system as in claim 23, wherein said polarizing beam splitter couples more light into the sample arm than the reference arm to increase the optical efficiency of the system.

34. The OCDR system as in claim 23, wherein said sample arm includes a polarization controller for selecting a desired polarization direction of the light wave onto the sample.

35. The OCDR system of claim 23, wherein at least one of the said sample arm or reference arm includes an optical fiber having an optical delay line for optical path length or optical phase modulation.

36. The OCDR system as in claim 23, wherein said polarization manipulator that rotates the returned light wave polarization to an orthogonal direction is a Faraday rotator with an optical rotation angle equal to 45° + M´90°, wherein M is an integer.

37. The OCDR system as in claim 23, wherein said polarization manipulator that rotates the returned light wave polarization to an orthogonal direction is a wave plate with an optical retardation substantially equal to $\frac{\lambda}{4} + M\frac{\lambda}{2}$, wherein M is an integer and λ is the center wavelength of the light source.

38. The OCDR system as in claim 23, wherein said polarization manipulator is a wave plate with a retardation which when combined with the retardation of the sample provides a net quarter wave plate effect and hence to rotate the overall returned light wave polarization to an orthogonal direction.

39. The OCDR system as in claim 23, wherein said polarization manipulator that rotates the returned light wave polarization to an orthogonal direction is a dynamically controllable quarter wave plate.

40. The OCDR system as in claim 23, wherein said detector is a light detection module that is polarization sensitive and hence requires a fixed or predetermined polarization state of the arriving light waves.

41. The OCDR system as in claim 23, wherein said light source is a low coherence source.

42. A method for performing optical coherence domain reflectometry comprising the steps of:

a. guiding light from a light source through a polarizing beam splitter and splitting light into a sample arm leading to a sample, and a reference arm leading to a reflector;

b. rotating the polarization direction of the returned light waves from said sample and reference reflector to an orthogonal direction prior to reentering the polarizing beam splitter;

c. at said polarizing beam splitter, combining the light waves returned from the sample arm and reference arm, and channeling said combined and returned light waves having an orthogonal polarization direction to a detector arm for interference signal extraction and processing.

43. An apparatus for performing optical coherence domain reflectometry on a sample comprising:

a light source for generating a light beam;

a path splitter for dividing the beam into a first portion that travels along a sample path and a second portion that travels along a reference path, with the portions of said beam traveling down and back along said paths and then being recombined at said path splitter;

at least one detector for measuring the recombined beam and generating output signals that correspond to an interferometric response;

a polarization sensitive element, said element being either functionally combined with the path splitter or being independent of the path splitter and located in the path of the light beam between the light source and the path splitter;

at least one polarization rotating element for rotating the polarization of the light beam after first passing through the polarization sensitive element in a manner such that when the recombined beam returns to said polarization sensitive element,

the recombined beam will be redirected away from said light source and to the at least one detector; and

a processor for evaluating the sample based on the output signals generated by the detector.

44. An apparatus as recited in claim 43, wherein said polarization sensitive element is a polarizing beam splitter.

45. An apparatus as recited in claim 44, wherein said polarizing beam splitter and said path splitter are separate elements.

46. An apparatus as recited in claim 45, wherein said polarization rotating element is located between the polarizing beam splitter and the path splitter.

47. An apparatus as recited in claim 46, wherein said polarization rotating element is defined by a Faraday rotator.

48. An apparatus as recited in claim 46, wherein said polarization rotating element is defined by a wave plate.

49. An apparatus as recited in claim 44, including a pair of polarization rotating elements, one of said polarization rotating elements being located in said sample path and one of said elements being located in the reference path.

50. An apparatus as recited in claim 49, wherein said polarization rotating elements are defined by a Faraday rotator.

51. An apparatus as recited in claim 49, wherein said polarization rotating elements are defined by a wave plate.

52. An apparatus as recited in claim 51, wherein said polarizing beam splitter and said path splitter are functionally combined.

53. An apparatus as recited in claim 52, including a pair of polarization rotating elements, one of said polarization rotating elements being located in said sample path and one of said elements being located in the reference path.

54. An apparatus as recited in claim 53, wherein said polarization rotating elements are defined by a Faraday rotator.

55. An apparatus as recited in claim 53, wherein said polarization rotating elements are defined by a wave plate.

56. An apparatus as recited in claim 52, further including a balanced detector, said balanced detector including a second detector and a polarizing element located between the polarizing beam splitter and the two detectors.

57. An apparatus as recited in claim 52, further including an analyzer between the polarizing beam splitter and the detector.

58. An apparatus as recited in claim 52, wherein said detector arm includes an optical dispersive element and a detector array for performing spectral domain detection.

59. An apparatus as recited in claim 44, wherein said sample path includes a beam scanner for creating a two or three-dimensional image of the sample.

60. An apparatus as recited in claim 44, further including an optical path length altering device associated with either the reference path or the sample path or both.

61. An apparatus as recited in claim 44, wherein the power splitting ratio of the path splitter is selected to direct a greater percentage of the beam power down the sample path.

62. An apparatus as recited in claim 43, wherein the power splitting ratio of the path splitter is selected to direct at least 70% of the beam power down the sample path.

63. An apparatus as recited in claim 44, wherein the sample is biological

64. An apparatus as recited in claim 44, wherein the sample is an eye.

65. An apparatus as recited in claim 44, wherein the said sample path includes a polarization controller for selecting a desired polarization direction of the light beam onto the sample.

66. An apparatus as recited in claim 44, wherein the said polarization rotator is a wave plate with a retardation which when combined with the retardation of the sample provides a net quarter wave plate effect so as to rotate the overall returned light wave polarization to an orthogonal direction.

67. An apparatus as recited in claim 44, wherein said polarization rotator is a dynamically controllable quarter wave plate.

68. An apparatus as recited in claim 44, wherein said light source is a low coherence source.

69. A method for performing optical coherence domain reflectometry on a sample comprising the steps of:

a) generating a light beam;

b) polarizing the beam;

c) splitting the beam into a first portion that travels along a sample path and a second portion that travels along a reference path, with the portions of said beam traveling down and back along said paths and then being recombined;

d) rotating the polarization of the light portions returning from the sample and reference paths;

e) redirecting the combined beam along a measurement path using a polarization sensitive optic;

f) measuring the recombined beam and generating output signals that correspond to an interferometric response; and

g) evaluating the sample based on the output signals generated by the detector.

70. A method as recited in claim 69, wherein a polarizing beam splitter defines the polarization sensitive optic.

71. A method as recited in claim 70, wherein the polarizing beam splitter also functions to split and then subsequently recombine the beam portions.

72. A method as recited in claim 71, wherein step of rotating the polarization of the light is performed separately on both beam portions in their respective sample and reference paths.

73. A method as recited in claim 70, wherein the beam is split with a separate path splitter located downstream from said polarizing beam splitter.

74. A method as recited in claim 73, wherein step of rotating the polarization of the light is performed separately on both beam portions before the beam portions are recombined in their respective sample and reference paths.

75. A method as recited in claim 73, wherein the step of rotating the polarization of the light portions occurs after the beams are recombined but before reaching the polarizing beam splitter.